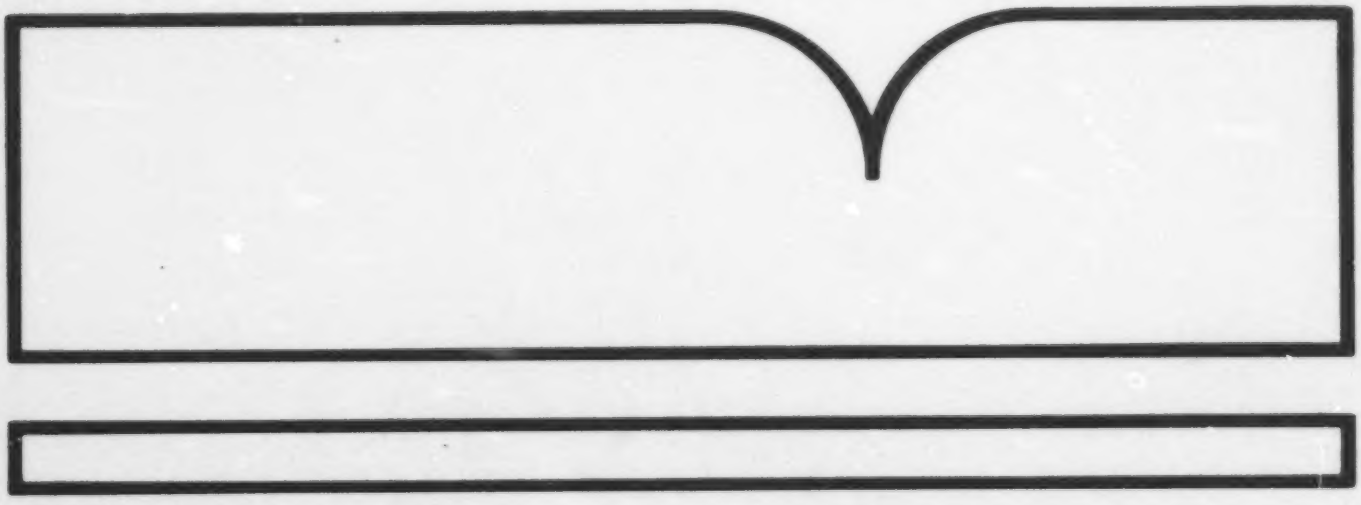
PB89-188734

Superfund Record of Decision (EPA Region 7) Syntex Agribusiness, Incorporated, Verona, Missouri (First Remedial Action), September 1988

(U.S.) Environmental Protection Agency, Washington, DC

5 May 88



U.S. Department of Commerce
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Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R07-88/013
September 1988

PB89-188734

EPA

Superfund Record of Decision:

Syntex Verona, MO

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Syntex Verona (SV) site, formerly operated as Hoffman-Taff, Inc., was purchased in 1969 by Syntex Agribusiness. The site is located 30 miles southwest of Springfield in extreme southwestern Missouri. Approximately 500 people live in Verona, Missouri, which borders on the site. The site area encompasses approximately 180 acres along the east bank of the Spring River. The majority of the active portion of the facility is located within the Spring River 100-year flood plain. SV was used to manufacture hexachlorophene from 1970 to 1971, which produced the byproduct 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), referred to as dioxin. From 1971 to 1988 EPA and Syntex Verona conducted numerous site investigations. The findings showed contamination both on- and offsite which may be related to the former activities at the site. The major areas identified as being contaminated are the Slough Area, Lagoon Area, Spill Area/Irrigation Area, Burn Area, and Trench Area. Dioxin contamination ranged from 1 ug/kg to 1,380 ug/kg, with the maximum concentrations occurring in the Lagoon Area. In addition to dioxin contamination, other organic and inorganic compounds were identified. The concentrations of these compounds were below the level of concern for human health. The primary contaminant of concern affecting the soil is dioxin.
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Syntex Verona, MO
First Remedial Action - Final
Contaminated Media: soil
Key Contaminants: dioxin

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

Availability Statement	19. Security Class (This Report) None	21. No. of Pages 49
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16. ABSTRACT (continued)

The selected remedial action for this site includes: excavation and offsite thermal treatment of dioxin-contaminated soil exceeding 20 ug/kg and offsite disposal of the ash residue; dismantling and decontamination of equipment with a series of solutions and aqueous rinses; installation of a clay cap with a vegetation cover over the Trench Area; and maintenance of vegetation cover over surface soil containing levels of dioxin from 1 ug/kg to 20 ug/kg. The estimated present worth cost for this remedial action is $5,617,000.

Tues. 6/14
@ 1:30 —
SCHAD

RECORD OF DECISION DECLARATION

SITE NAME AND LOCATION

o Syntex Agribusiness, Inc., Verona, Missouri

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Syntex Agribusiness site in Verona, Missouri. This final plan has been developed in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

DESCRIPTION OF THE SELECTED REMEDY

This remedial action represents the final action for dioxin-contaminated soils and equipment at the Syntex Agribusiness site. This remedial action addresses the principal threats at the site by excavation and thermal treatment of soils which exceed the 20 ppb action level established for the protection of public health and the environment at commercial facilities. Thermal treatment results in the destruction of dioxin, permanently removing the contamination from the environment. A vegetative cover will be maintained over surface soils containing levels of dioxin from 1 to 20 ppb.

The major components of the selected remedial action include:

- Excavation of all dioxin-contaminated soils exceeding the 20 ppb action level.
- Dismantle, as appropriate, and clean contaminated equipment with a series of solvent and aqueous rinses.
- Thermal treatment of soils and cleaning solutions excavated and removed from the site.
- Maintain vegetative cover over surface soils containing greater than 1 ppb dioxin.
- Install a vegetative clay cap over the Trench Area and a gravel drainage-interception trench upgradient of the Trench Area.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility or volume as a principal element and utilizes permanent solutions and alternative treatment (or

resource recovery) technologies to the maximum extent practicable. The remedy under this operable unit only addresses dioxin-contaminated soils and equipment. A five year review will be conducted at the Trench Area because contamination will remain above the health-based criteria. This review will serve to assure effectiveness of the remedy in the Trench Area. A second operable unit will be prepared if necessary to address remediation of the groundwater, Spring River and the Trench Area at the site.

5.5.88
Date

Morris Kay
Regional Administrator
Region VII

RECORD OF DECISION

FOR

FINAL MANAGEMENT OF DIOXIN CONTAMINATED SOIL AND EQUIPMENT AT

SYNTEX AGRIBUSINESS, INC.

VERONA, MISSOURI

Prepared by:

U.S. ENVIRONMENTAL PROTECTION AGENCY

April 29, 1988

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1.0 INTRODUCTION

1.1 BACKGROUND

The facility, now owned by Syntex Agribusiness Inc. is located in extreme southwestern Missouri in the town of Verona. Verona (population 500) is approximately 30 miles southwest of Springfield, Missouri.

The Spring River, which arises about three miles south of Verona, flows northward along the western outskirts of Verona. The Syntex facility is located west of Verona and occupies about 180 acres primarily along the east bank of the Spring River. The majority of the active portion of the facility is located within the 100-year floodplain of the Spring River.

The facility was used to manufacture hexachlorophene from 1970 to 1971. The manufacturing process resulted in the by-product production of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), often referred to simply as dioxin. Dioxin, trichlorophenol (TCP), and hexachlorophene have been listed as hazardous wastes under the Resource Conservation and Recovery Act (RCRA) and hazardous substances under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

The past operation of a leased production building at the Verona facility has resulted in several areas of known or suspected dioxin contamination. The major subsite areas of known or suspected contamination addressed in this plan are the: Lagoon Area; Slough Area; Spill Area/Irrigation Area; Trench Area; and Burn Area.

1.2 SITE HISTORY

The environmental concerns at the Verona facility, began about 1960 when the facility was owned and operated by Hoffman-Taff, Inc. Hoffman-Taff produced 2,4,5-trichlorophenoxy-acetic acid (2,4,5-T) for the U.S. Army as part of the production of the defoliant commonly known as Agent Orange.

In 1969, Syntex Agribusiness, Inc., purchased the Verona facility from Hoffman-Taff. Northeast Pharmaceutical and Chemical Company (NEPACCO) had previously entered into a lease agreement with Hoffman-Taff, which was continued after the purchase by Syntex.

The production of 2,4,5-T and hexachlorophene involves the intermediate production of 2,4,5-trichlorophenol (TCP) and subsequently the potential formation of dioxin, (2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD). However, these "contaminants" were removed from the pharmaceutical grade hexachlorophene, thus creating waste streams containing TCP and dioxin. The production of hexachlorophene was discontinued in 1972 when the FDA placed restrictions on the use of hexachlorophene and the market collapsed.

1.3 PREVIOUS STUDIES

Numerous studies at the Verona facility date as far back as 1971. Several of the studies involved off-site locations that were suspected of being related to the facility.

The following is a brief chronology of the various investigations related to the Syntex, Verona site.

1971 Missouri Geological Survey and Water Rersources conducted dye test to determine migratory paths leading from site. Missouri Conservation Department sampled Spring River 1.5 miles downstream of Syntex.

1978 EPA collected water, sediment and fish samples at and 3 miles downstream from Syntex.

1981 Fish and sediment samples were taken from Spring River.

1982 Fish and sediment samples were collected from Spring River.

Trench perimeter and boring soil samples were collected by Syntex. Additional soil sampling was conducted in the burn, irrigation and old lagoon subsite areas by Syntex under EPA oversight.

Consent Order between EPA and Syntex, see Section 1.5.

1983 Fish and sediment samples were collected from Spring River by EPA and MDNR.

Consent Agreement between EPA and Syntex, see Section 1.5.

1984 Fish and sediment samples were collected from Spring River by EPA and MDNR.

1985 Syntex collected soil samples under EPA oversight. Groundwater samples were collected from wells on the facility property. Fish and sediment samples were collected from stations on the Spring River.

1986 Groundwater samples were collected from wells on the facility property. Fish and sediment samples taken from Spring River.

1987 Fish samples were collected from the Spring River.

1988 Sediment samples were collected from the Spring River.

1.4 SUMMARY OF INVESTIGATIONS AT THE SYNTEX, VERONA SITE

The numerous investigations at the Syntex, Verona site have found contamination both on and off site which may be related to the former activities at the site. The following text summarizes these findings.

1.4.1 Soil

The soil sampling efforts at the Syntex facility have identified several areas or subsites significantly contaminated with dioxin. These subsites are delineated on Figure 1.1. Most of the contaminated areas or subsites are, or have been

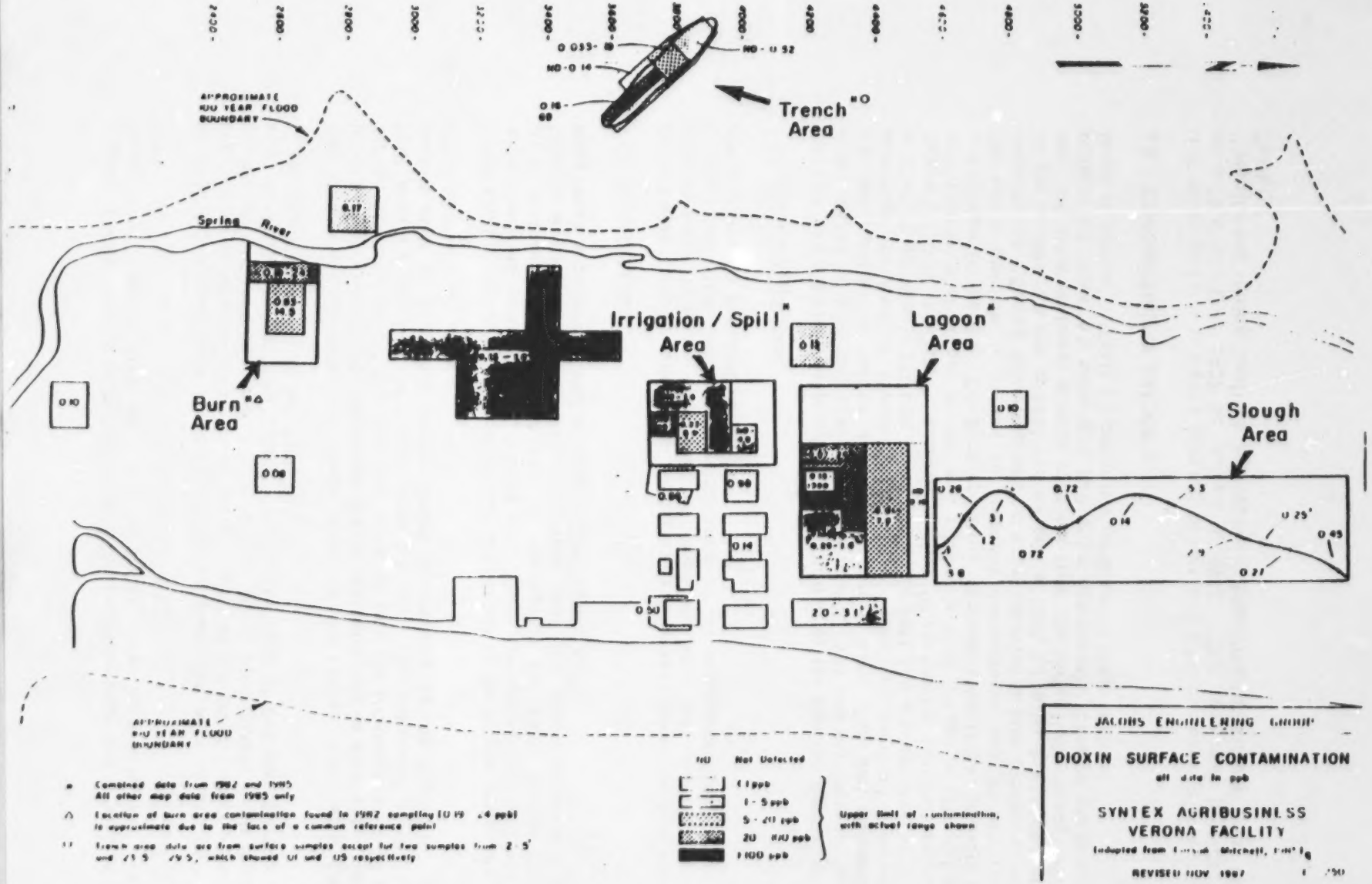
Trench Area
Irrigation / Spill Area
Lagoon Area
Burn Area
Slough Area
Spring River
APPROXIMATE 100 YEAR FLOOD BOUNDARY
APPROXIMATE 100 YEAR FLOOD BOUNDARY
JACOBS ENGINEERING GROUP
DIOXIN SURFACE CONTAMINATION
all data in ppb
SYNTEX AGRIBUSINESS
VERONA FACILITY
REVISED NOV 1987
ND Not Detected
Upper limit of contamination, with actual range shown

Figure 1.1

associated with specific plant activities. These subsite areas are labeled as the: Slough Area; Lagoon Area; Spill Area Irrigation Area; Burn Area; and Trench Area.

In addition, several areas scattered across the plant site were investigated for fugitive contamination. The "Grid" Area is used as the general description for the overall site grounds sampling efforts. The dioxin contaminant levels in these areas generally are less than 1 ppb, with the exception of one area directly east of the Lagoon Area which has 3 ppb dioxin.

The highest concentrations of dioxin occur in the Lagoon Area, with dioxin levels as high as 1380 ppb. Maximum dioxin concentrations in other subsite areas are the Trench Area 67 ppb, the Burn Area 27 ppb, the Irrigation Area 29 ppb. Spill Area 4.9 ppb and the Slough Area 5.3 ppb. The remainder of the sigh: showed little or no dioxin contamination as revealed during the "Grid" Area sampling effort.

Other organic and inorganic compounds, in addition to the dioxin contamination, were identified on the Syntex, Verona site. These are summarized in Table 1.1. As is discussed in Section 1.6 and 3.1 the Agency for Toxic Substances and Disease Registry (ATSDR) has determined that the concentration of these compounds is below the level of concern for human health.

1.4.2 Groundwater

Groundwater samples collected at the Syntex facility have shown no dioxin in the groundwater. However, several other compounds have been identified in the groundwater. The maximum concentration of the compounds detected in the groundwater are presented in Table 1.2

1.4.3 Fish and Sediment

The fish and sediment sampling program required by the Consent Agreement and Order signed by EPA and Syntex on September 6, 1983 and discussed in Section 1.5, has resulted in regular analyses of Spring River fish and sediment to determine the level of dioxin contamination. Analyses indicated a maximum level of 52 ppt dioxin (TCDD) in whole fish in 1981 and a lower level of 17 ppt dioxin (TCDD) in 1986. Analysis of fish fillets (edible portion) indicate a maximum level of 40 ppt in 1982 and a lower level of 2.5 ppt in 1986, 0.3 miles downstream of the site. The Food and Drug Administration (FDA) advisory level for edible portions is 25 ppt for reduced consumption and 50 ppt for no consumption. Spring River sediment samples revealed dioxin concentrations of 12 ppt in 1981, 1.6 ppt in 1984 and 6.4 ppt in 1987, 0.3 miles downstream of the site. All other sediment samples collected from the period 1981 through 1987 at stations 0.3 miles, 6.0 miles and 12.0 miles downstream revealed nondetectable levels of dioxin. Table 1.3 presents a summary of these analyses.

1.5 ENFORCEMENT HISTORY

A Consent Order was signed between Syntex and EPA pursuant to Section 3013 of RCRA 42, USC 6927 on August 6, 1982. The agreement provided for "...monitoring, testing, analyses, and reporting regarding the disposal areas on the Facility."

TABLE 1.1

SYNTEX

Summary of Maximum Concentration of Non-Dioxin Contaminants
1982, 1984 and 1985 Data
All Concentrations in ppm

Compound	Lagoon Soil	Irrigation Soil	Trench Soil	Trench Water	Other*
1,2,4,5-tetrachlorobenzene	.465	.238	.0796	-	.0097
1,2,4-trichlorobenzene	46.40	-	3.670	.380	-
1,2,4-trimethylbenzene	-	-	-	43.20	-
1,2-dichlorobenzene	.590	-	-	-	-
1,3-dichlorobenzene	M	-	-	-	-
1,4-dichlorobenzene	1.170	-	20.20	.290	-
1-chlorodecane	-	-	.330	-	-
2,4,5-trichlorophenol	244.0	1.260	20.70	5.70	.0582[A]
2,4,6-trichlorophenol	134.0	-	.890	.120	-
2,4-dichlorophenol	.830	-	.890	-	-
2-methylphenol	-	-	6.440	-	-
2-methylnaphthalene	-	3.750	1,400.0	47.0	-
4-methylphenol	-	-	4.980	1.0	-
Acenaphthene	-	-	3.250	-	-
Acetone	.550	-	-	-	-
Anthracene	-	-	27.60	-	-
Aroclor 1232	.240	-	-	-	-
Aroclor 1242	-	-	11.30	-	-
Aroclor 1248	2.70	-	-	-	-
Aroclor 1254	.297	-	.580	-	-
Benzo (B) fluoranthene	M	-	-	-	-
Benzo (K) fluoranthene	M	-	-	-	-
Benzoic acid	M	-	11.10	-	-
Benzyl alcohol	.015	-	-	-	-
Bis (2-ethylhexyl) phthalate	1.730	-	5.410	.160	-
Butyl benzyl phthalate	1.60	-	-	-	-
Chlorobenzene	.105	-	.0089	-	-
Chrysene	M	-	-	-	-
Di-n-butyl phthalate	-	-	M	1.40	-
Di-n-octyl phthalate	M	-	-	-	-
Dibenzofuran	-	-	1.110	1.60	-
Ethylbenzene	.0068	-	.033	-	-
Fluoranthene	M	-	-	-	-
Fluorene	-	-	58.0	2.30	-
Fluorotrichloromethane	-		.0085	-	-
Hexachlorophene	170.0	13.80	3.490	-	3.740[B]
Methylene chloride	.790	.250	.094	-	-
Naphthalene	.490	1.390	335.0	13.0	-
o-Xylene	.039	-	200.0	-	-
Phenanthrene	1.50	.780	120.0	5.50	-
Phenol	-	-	3.670	1.800	-
Pyrene	M	-	-	-	-
Toluene	1.220	-	.30	-	-
Tridecane	-	-	32.0	-	-

* - General area outside of the smaller, individually sampled areas (lagoon, irrigation, and trench areas)

A Concentrations as high as 1,540 have been found at a depth of 3-4.5 feet.
B Concentrations as high as 46,200 have been found at a depth of 3-4.5 feet
M Compounds identified but not quantified.

TABLE 1.2

Maximum Concentrations of Tentatively Identified Compounds in Groundwater (ppm) 1985 and 1986 Data

1,1,1-trichloroethane	.047
1,1,2,2-tetrachloroethane	.320
1,1-oxybisbenzene	.120
1,2,3-trimethylbenzene	.023
1,2,4-trimethylbenzene	.005
1,2-dichlorocyclohexane	.047
1,2-dimethylbenzene	.156
1,3-dimethylbenzene	.111
1,3-dinitrate-1,2,3-propanetriol	.784
1,4,-dichlorobenzene	.058
2,2-bi-1,3-dioxolane	.045
2,2-dimethyl-1,3-propanediol	.036
2,2-thiobisethanol	.726
2,5-dimethyl tetrahydrofuran	.012
2-methyl-3-(1-methylethyl) oxirane	.058
3,5,5-trimethyl-1-hexene	.001
3-chlorophenol	.151
4-chlorophenol	.110
4-fluoro-1,1-biphenyl	.050
5-methyl-1-hexene	.047
5-methyl-1-hexyne	.046
6-nitro-2-picoline	.148
Benzeneacetic acid	.031
Bromocyclohexane	.002
Chlorobenzene	.048
Dimethylbenzene	.046
Ethylbenzene	.041
Hexanedioic acid, dioctyl ester	.386
Hexanoic acid	.327
Methylbenzene	.090
Methylene chloride	.047
Methylguanidine	.842
N-n-dimethylforamide	.265
Pentanoic acid	.061
Tetrahydro-2H-pyran-2-methanol	.038
Trans-4-chlorocyclohexanol	.014
Trichloroethane	.004

TABLE 1.3

FISH (SUCKER TYPE) AND SEDIMENT SAMPLES TAKEN FROM THE SPRING RIVER

SEDIMENT SAMPLES (ppt)

Location	1981	1983	1984	1985	1986	1987
Loc No. 1 0.3 Miles Downstream	12	ND (27)	1.6	ND (3.0)	ND (7.5)	6.4
Loc No. 3 6.0 Miles Downstream	ND(10)	ND(9)	ND (1.5)	ND (2.3)	ND (2.6)	ND (0.8)
Loc No. 5 12.0 Miles Downstream	-	-	ND (1.2)	ND (2.5)	ND (9.1)	ND (0.8)

FISH SAMPLES (ppt)

	Sample Type	1981	1982	1983	1984	1985	1986	1987
Location No. 1	Whole fish	52	-	28	26	14	8.5	21.3
0.3 Miles Downstream	fillet	-	40	20	4	3.0	2.5	4.8
Location No. 2	Whole fish	39	-	-	22-34	11	16.9	13.4
3.0 Miles Downstream	fillet	-	-	-	4	3.0	4.4	3.4
Location No. 3	Whole fish	-	-	-	12	6.0	6.2	7.0
6.0 Miles Downstream	fillet	-	-	-	3	ND	1.3	1.8
Location No. 4	Whole fish	-	-	-	11	5.4	6.9	8.3
9.0 Miles Downstream	fillet	-	-	-	2	1	1.7	1.3
Location No. 5	Whole fish	-	-	-	3	ND	1.8	1.7
12.0 Miles Downstream	fillet	-	-	-	ND	ND	1.2	0.3

- data not available
ND None Detected
( ) Detection Limit
The 1981 and 1983 data was generated by the U.S. EPA.
The 1982 data was generated by Dr. Gross of the University of Nebraska-Lincoln
The 1984 and 1985 data was generated in compliance with the Fish and Sediment Plan and the analyses were performed by Dr. Gross at the University of Nebraska-Lincoln.
The 1986 and 1987 data was generated in compliance with the Fish and Sediment and the analyses were performed at Syntex Research Laboratory in Palo Alto, CA.

A second Consent Agreement and Order between Syntex and EPA was signed September 6, 1983 pursuant to Section 106 of CERCLA, 42 USC 9607 and Section 3013 of RCRA. The order required the following actions:

- o posting of warning signs around specified disposal areas;
- o development and submittal of a Sampling and Analysis Plan for defining the extent and nature of dioxin contamination;
- o implementation of Sampling and Analysis Plan upon approval by EPA;
- o development and submittal of a Fish and Sediment Sampling Plan for the dioxin contamination in the Spring River;
- o implementation of a Fish and Sediment Sampling Plan upon approval by EPA;
- o preparation and submittal of a Remedial Alternatives Report based on the results of Sampling and Analysis Plan;
- o preparation and submittal of an implementation plan which will include plans and specifications for the preferred remedial alternative, schedule for implementation and reporting, description of the necessary reports and safety plans.

This Consent and Agreement Order is currently being carried out by Syntex.

The site has been placed on the National Priority List of Hazardous Waste Sites. In addition the site is included on the State of Missouri Registry of Abandoned or Uncontrolled Hazardous Waste Disposal Sites pursuant to the Missouri regulation found at 10 CSR 25-10.010.

1.6 PUBLIC PARTICIPATION

Public participation in the process of selecting the final remedy at other Southwest Missouri dioxin sites began in May 1984 when the EPA announced plans to set up an incinerator system at the Denney Farm site. Public hearings were held by the EPA and the Missouri Department of Natural Resources (MDNR) in September 1984 regarding the permit for the incinerator system. The incinerator arrived at the Denney Farm on December 15, 1984 and between February and April 1985 conducted four trial burns. These trial burns successfully and safely removed and destroyed the dioxin contained in the contaminated materials. On July 18, 1985 the incinerator began burning a variety of dioxin-contaminated soils and liquids. Phase I operations were completed on September 19, 1987 with materials from Denney Farm, Erwin Farm, Talley Farm, Rusha Farm and Neosho Wastewater Treatment School being successfully treated. In March 1987 the EPA and MDNR held a public meeting to discuss extending the permit for incinerator operation at Denney Farm. The new permit allowed the EPA to operate the incinerator through May 1989 as part of Phase II. Proposed activities under Phase II include burning dioxin-contaminated material from additional southwest Missouri sites, i.e. Baldwin Park in Aurora, the Syntex, Springfield facility, and the Syntex, Verona facility.

Public participation in the selection of a final remedial action for the Syntex Agribusiness site in Verona, Missouri began with the public release of the Syntex "Remedial Alternatives Report," the EPA "Proposed Plan for Final Management of Dioxin Contaminated Soil and Equipment, Syntex, Verona" and Administrative Record on March 21, 1988. The Syntex Report evaluated remedial alternatives for the dioxin-contaminated soil and equipment and presented general plans for future monitoring of the local groundwaters. The EPA Proposed Plan recommended excavation and treatment of dioxin-contaminated soils and equipment above an action level of 20 ppb dioxin for surface soils and

maintenance of a vegetative cover over soils containing between 1 ppb and 20 ppb dioxin. Installation of a vegetated soil cap and gravel drainage-interception trench was proposed for the Trench Area.

A public comment period was held from March 21, 1988 through April 22, 1988 for the Syntex Remedial Alternatives Report and EPA Proposed Plan. A public meeting was held on March 29, 1988 to discuss the Syntex Remedial Alternatives Report and the EPA Proposed Plan.

All documents used in selection of the remedy are included in the Administrative Record. The Record of Decision and Responsiveness Summary will also be included in the Administrative Record which is available for review at a local repository in Verona, Missouri and the U.S. EPA Region VII office in Kansas City, Kansas.

1.7 SUMMARY OF SITE RISKS

1.7.1 Contaminants of Concern

The primary contaminant of concern at the site is 2,3,7,8 TCDD, commonly referred to as dioxin. Dioxin is considered one of the most toxic compounds known, with the LD-50 (lethal dose to 50 percent of tested populations) level for male guinea pigs, the most sensitive species, being 0.6 ug/kg.

Although dioxin has been highly toxic in all species tested, there are large species differences in sensitivity, with the LD-50 for hamsters being 1,157 to 5,051 ug kg The characteristic signs and symptoms of lethal dioxin poisoning are severe weight loss and thymic (immune system) atrophy. Death in laboratory animals usually occurs many days after exposure. After subchronic or chronic exposure to dioxin in rats or mice, the liver appears to be the most severely affected organ, although systemic hemorrhage, edema (excess fluid accumulation), and suppressed thymic activity are also observed.

Animal studies have also demonstrated that dioxin is teratogenic (causes malformities) and fetotoxic (toxic to fetus) in mice, rats, rabbits, monkeys and ferrets and is fetotoxic in monkeys. Also, since dioxin produced statistically significant increased incidents of tumors in two animal species, there is sufficient evidence to conclude that dioxin is an animal carcinogen. In fact, dioxin is the most potent animal carcinogen evaluated to date by the EPA Carcinogen Assessment Group. For comparison, dioxin is about 50 times as potent as the third most potent animal carcinogen evaluated (bis-chloromethyl ether) and about 50 million times more potent than vinyl chloride (a widely known carcinogenic substance).

Study results concerning humans that have been exposed to herbicides and other chlorinated chemicals containing dioxin as a contaminant indicate that excessive exposure leads to altered liver function and lipid metabolism, and neurotoxicity. In addition, humans may develop skin lesions, chloracne and hyperpigmentation.

The available epidemiologic evidence concerning the carcinogenicity of dioxin in humans is inadequate. Considering the available animal carcinogenic and epidemiologic data, however, the overall weight-of-evidence classification for dioxin (using EPA's interim classification scheme) is category B2, a probable human carcinogen.

Polychlorinated dibenzo-p-dioxins are a class of chlorinated tricyclic aromatic hydrocarbons consisting of two benzene rings connected by a pair of oxygen atoms. According to the position and number of chlorine atoms, it is possible to form 75 different types of chlorinated dioxins. The word "dioxins" is often used to refer to this class of compounds, especially with respect to the highly toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) that is present at Syntex, Verona. This class of compounds is rather stable in the presence of heat, acids, and alkalis. They are also chemically stable and start to decompose only at temperatures greater than 500 degrees Celsius; the percent of decomposition depends upon the residence time at high temperature and the proportion of oxygen in the heated zone.

Physico-chemical properties suggest that dioxin will adsorb tightly to organic material in soil, resulting in low mobility. Once in the soil, degradation processes tend to be very slow, with half lives estimated to be ten years or longer.

Calculated and experimental results show that dioxin will concentrate in biota present in aquatic media. Reported bioconcentration factors of dioxin in fish range from about 2,000 to 30,000. In mammals, dioxin is readily absorbed through the gastrointestinal tract. Absorption through intact skin has also been reported. Absorption may decrease dramatically if dioxin is adsorbed to particulate matter such as activated carbon or soil. After absorption, dioxin is distributed to tissues high in lipid (fat) content; however, in many species the liver is a major storage location. Metabolism of dioxin occurs slowly, with metabolized dioxin excreted in the urine and feces. Unmetabolized dioxin can be eliminated in the feces and in the milk.

1.7.2 Risks to Human Health and the Environment

Continued long-term direct contact with or ingestion of soils would present the greatest threat to human health. This exposure potential for humans can be limited by controlling site access. Ingestion of dioxin could occur if fish containing levels of dioxin from the Spring River were consumed or by direct ingestion of Syntex, Verona plant soils. Wildlife (deer, turkey, rabbit) in the slough area would be susceptible to contamination, as historically there were no controls on animal access in this subsite area.

Inhalation of dioxin-contaminated airborne particulates presents a potential route of human exposure. The principal concern for inhalation of contaminated particulates would be for Syntex, Verona employees and onsite workers during periods of onsite construction activities involving disturbance of contaminated soils. Mitigative measures exist to control this risk.

Ingestion of plants grown in contaminated soil represents a potential exposure route, although there is uncertainty regarding the potential for uptake of dioxin in plant life. Dioxin uptake in many plants appears to be minimal. This potential pathway would be limited by controlling site access. Land use restrictions represent another effective means of controlling this exposure potential, although potential uptake in plants would be unaffected.

The most significant environmental problem which could be expected at Syntex, Verona is the transport of dioxin to the Spring River due to erosion of surficial soils. A limited potential exists for surface contamination to reach the river by transport during rainfall events, particularly during periods of flooding at the

plant site which lies in the floodplain of Spring River. The potential for suspended contaminated sediment to reach the Spring River during normal flow conditions is much lower. Stormwater is normally retained on site until it is absorbed into the ground.

The threat to human health and the environment due to bioaccumulation in fish as a result of the release of dioxin from the Syntex, Verona site appears to be decreasing. Although fish in the Spring River have shown detectable levels of dioxin, contaminant levels have consistently been below the advisory level of 50 ppt designated by the Food and Drug Administration since 1982.

1.7.3 Risk Assessment

A paper was published in 1984 by Renate D. Kimbrough, M.D., et al., of the Center for Environmental Health, Centers for Disease Control, which evaluated acceptable soil concentrations of dioxin in residential settings. A risk assessment was performed in this paper on the basis of several chronic feeding studies in rodents. The smallest lower confidence bound corresponding to a 1 X 10^{-6} incremental cancer risk was calculated to be 28 femtograms (10^{-15}) per kilogram body weight per day (fg/kg b.w./day). This calculation was based on data for hepatocellular carcinoma (liver cancer) and neoplastic nodules. This means that a lifetime average dosage of 28 fg/kg b.w./day would be expected to result in one additional case of this particular type of cancer for each million individuals so exposed. This number is based upon a number of conservative assumptions, as discussed in the 1984 paper. Cancer in other types of body tissues would occur at higher dosages. On the bases of data for tissue less sensitive than the liver, the paper reported that an incremental cancer risk of 1 X 10^{-6} would be expected to occur at a lifetime dosage level of 1,428 fg/kg b.w./day.

Intake levels for residential exposure were calculated by Kimbrough, et al., for dermal (skin), ingestion and inhalation exposure pathways. In residential settings, the principal exposure pathway is through ingestion of contaminated soil. Ingestion of soil by children is of particular concern in residential areas. Small children may consume soil directly during play, although inadvertent ingestion of soil by both children and adults can also occur. The paper estimated the average lifetime daily dose resulting from exposure to 1 ppb dioxin in a residential setting to be 636.5 fg/kg b.w./day. This recommendation formed the basis for the cleanup criteria of 1 ppb dioxin which has been applied for the cleanup of residential sites.

Dioxin cleanup levels have been established for different media during cleanup of other Missouri dioxin sites. A cleanup level of 4 picograms per square meter (pg/m^2) has been recommended for interior surfaces by CDC. The action level for dioxin in water is limited by the detection limit, which by current methods is approximately 1 ppt. A level of 3 pg/m^3 representing the average of 14 data points has been used as a level of concern for airborne dioxin levels during the cleanup of other eastern Missouri dioxin sites.

The 1984 Kimbrough paper recommended that risk management decisions by EPA should be based upon a consideration of the specific circumstances and exposure opportunity at each contaminated site. The paper noted that in certain nonresidential areas, higher levels may present an acceptable degree of protection of human health. Conversely, soil levels less than 1 ppb dioxin may be of concern in areas used for certain agricultural purposes.

Potential exposure at commercial areas, in addition to being less frequent and of shorter duration, occurs through different primary pathways than in residential settings. Ingestion is the principal exposure pathway of concern in residential settings due to the potential for regular contact by small children who may consume substantial quantities of soil. In certain non-residential areas there is less opportunity for this type of regular exposure by small children to occur. In commercial or industrial settings where occupational exposure occurs, direct contact is the primary pathway of concern. The acceptable dioxin soil level is controlled in these non-residential settings by limiting the potential for such contact to occur.

The Center for Disease Control, through the Agency for Toxic Substances and Disease Registry (ATSDR) has recently provided supplemental information to the 1984 paper by Kimbrough, et al., in a series of correspondence between ATSDR and EPA which evaluates exposure to soils contaminated at levels in excess of 1 ppb in non-commercial areas. The ATSDR advisory concludes that the average lifetime daily dosage in a commercial setting contaminated at 20 ppb dioxin is 33 fg/kg b.w./day. This calculated dosage is below the average daily dose estimated to be of concern for public health in the 1984 article by Kimbrough, et al. In addition, this dosage is substantially below the estimated dosage corresponding to residential exposure to 1 ppb dioxin (636.5 fg/kg b.w./day). The Agency has therefore concluded that certain types of non-residential exposure to soil contaminated at 20 ppb dioxin is below a level of concern for public health. The Agency, in consultation with the ATSDR, has concluded that a remedial action at Syntex, Verona resulting in the removal of soils exceeding 20 ppb would reduce the risk associated with non-residential land usage to an acceptable level.

1.8 DOCUMENTATION OF SIGNIFICANT CHANGES

The selected remedy presented in this document is identical to the remedy proposed in the EPA Proposed Plan of March 22, 1988 except for the following determination. The Agency has determined that because this remedy will not result in hazardous substances remaining at the plant site above health-based levels, the five year facility review will not apply to the action at the plant subsite areas. However, a five year review will be conducted at the Trench Area because contamination will remain above the health-based criteria. This review will serve to assure effectiveness of the remedy in the Trench Area.

2.0 ALTERNATIVES EVALUATED

The final evaluation of the remedial alternatives presented in the Proposed Plan were based on the subsite considered, i.e. Slough Area, Lagoon Area, Spill/Irrigation Area, Burn Area and Trench Area; subsite location; and the levels of dioxin detected. The primary remedial alternatives considered for all areas of the Syntex, Verona site which contain levels of dioxin greater than 20 ppb, were 1) In-place containment with vegetative cover and 2) Excavation and Thermal Treatment. Soil sampling, using a 95 percent confidence level sampling protocol, would be conducted prior to excavation of any area to establish the extent of surface contamination. Confirmation sampling would be conducted subsequent to excavation to verify that dioxin concentrations average less than 20 ppb. The remedial action considered for the other areas containing dioxin less than 20 ppb, was to establish and maintain vegetative covers (including topsoil as necessary) Those alternatives considered for each potentially affected subsite are briefly described in Table 2.1. A description of these remedial alternatives is provided

below.

2.1 NO ACTION

ALTERNATIVE 1. MAINTAIN EXISTING CONDITIONS

The no action alternative was to leave the site conditions as they currently exist. Also, various institutional controls, (i.e. fencing and deed restrictions), were considered under this alternative.

2.2 STABILIZATION

ALTERNATIVE 2. ESTABLISH AND MAINTAIN VEGETATION

This alternative consisted of seeding, mulching and fertilizing the subsite grounds. Prior to these activities, each subsite would be backfilled as necessary to raise the elevation to grade. This action was the sole remedial alternative proposed for the "Grid" Area, the Spill Area and the Slough Area.

ALTERNATIVE 3. IN-PLACE CONTAINMENT

The options listed below (3A through 3D) were proposed for one or more of the subsites. Each option proposed to keep the dioxin-contaminated soils in place with various types of covers. The covers would be constructed to prevent significant infiltration, promote runoff and avoid ponding.

Alternative 3A: One-Foot Vegetative Soil Cover

Alternative 3A was proposed for several subsite areas, i.e. Irrigation Area, Burn Area, Lagoon Area. This option would be conducted as a sole remedy or subsequent to excavation activities, depending on the levels of dioxin in the soil and would be followed by actions to establish and maintain vegetation as described in Alternative 2.

Alternative 3B: Rock Base with Asphalt Cover

Alternative 3B was proposed for the Spill Area. This alternative included placement and grading of a 4 to 6 inch nominal stone layer over the existing rock base. A four-inch layer of asphalt would be installed and maintained over the stone base layer.

Alternative 3C: Clay Backfill with Six-Inch Vegetative Cover

Alternative 3C was proposed for the Slough Area. This activity involved placing clay in the Slough channel as a backfill material and grading the surface to produce a gradual swale. Six inches of topsoil would then be added to support a vegetative cover which would be established and maintained as described in Alternative 2.

TABLE 2.1

SUMMARY OF REMEDIAL ALTERNATIVES

Area	Proposed Remedial Alternatives
Grid area	Maintain vegetation.
Burn area	No Action Stabilization Establish and maintain vegetation; In-place containment with a one-foot vegetated soil cover; Removal* Excavation and thermal treatment of dioxin-contaiminted soils
Spill Area	No Action Stabilization Establish and maintain vegetation; In-place containment with an asphalt cover; Deep tillage of surface soils. Removal Excavation and onsite burial of low level contaminated gravel.
Irrigation Area	No Action Stabilization Establish and maintain vegetation; In-place containment with a one foot vegetated soil cover; Deep tillage of surface soils; Removal* Excavation and thermal treatment of dioxin-contaminated soils
Trench Area	No Action Stabilization In-place containment with a one foot clay cap, one foot vegetated soil cover; Monitoring - Subsurface
Lagoon Area	No Action Stabilization In-place containment with a one foot vegetated soil cover; Deep tillage of surface soils; Removal* Excavation and thermal treatment of dioxin-contaminated soils
Slough Area	No Action Stabilization Backfill and establish vegetation cover.
Old NEPACCO Equipment	Clean, wipe, test, and determine proper disposal or reuse conditions.
Photolysis Equipment	Solvent rinse, acid rinse, water rinse, disassemble, inspect, wipe test and determine proper disposal or reuse conditions.
Groundwater	Install monitoring wells and assess data generated at plant site and in Trench Area.
Solvents and Washes	Hold solvents for eventual disposal. Treat aqueous washes to remove TCDD to less than 1 ppt before evaporation.

*Excavation will involve those soils containing dioxin above the 20 ppb action level.

Alternative 3D: Gravel Backfill, Twelve-Inch Clay Cap, Twelve-Inch Vegetated Cover

Alternative 3D was proposed for the Trench Area. This activity would involve: backfilling trench depressions to the original grade with gravel aggregate to provide a stable, compacted fill; installing a 12" layer of compacted clay extending ten feet beyond the trench boundaries, sloped to facilitate run off; installing a 12" layer of topsoil over the clay layer; and reestablishing vegetation.

ALTERNATIVE 4. DEEP TILLAGE OF SURFACE SOILS

This alternative involved inverting the surface soil layer to bury low level surface contamination beneath one to two feet of soil. The tilled area would subsequently be revegetated. Verification sampling would be performed after tillage to confirm the absence of surface contamination.

2.3 REMOVAL

ALTERNATIVE 5. EXCAVATE TOP SIX INCHES OF SURFACE MATERIAL, BACKFILL, ESTABLISH AND MAINTAIN VEGETATION

This alternative involved the excavation of the top six inches of cover material with a backhoe. The removed material would be disposed of onsite in other excavated areas and covered with one-foot of topsoil. The excavated area would be backfilled with topsoil to the existing grade and a vegetative cover established as described in Alternative 2. This alternative was specifically proposed for the Spill Area where six inches of gravel lie atop a section of ground contaminated with dioxin below 20 ppb.

ALTERNATIVE 6. EXCAVATION OF ALL SOILS CONTAMINATED WITH DIOXIN ABOVE THE 20 PPB ACTION LEVEL AND OFFSITE THERMAL TREATMENT

This alternative provided for excavation of all soils showing concentrations of dioxin above 20 ppb based on the 95 percent confidence level . The subsites potentially affected include the Burn, Irrigation and Lagoon Areas. A backhoe would be used for the excavation. Gravels from the Spill Area could be used as backfill for excavated areas greater than one foot deep.

The excavated soils and debris would be placed in a dump truck, covered and transported approximately 15 miles to the existing thermal treatment unit at the Denney Farm Site. All ash and residues would be disposed at a State approved landfill. This action was and remains contingent on the success of ongoing negotiations to obtain an access agreement with the owner of Denney Farm. If these negotiations were not successful, then contaminated soils would be excavated and stored onsite in compliance with the applicable EPA and State rules and regulations.

2.4 EQUIPMENT REMEDIATION

Old equipment originating from NEPACCO's operation and equipment used in the onsite photolysis process remain onsite. An option to remediate this equipment allowing future use was proposed. However, if this equipment could not be satisfactorily cleaned then it would be disposed of according to the action

schedule provided below, under Section 2.4.1. Ultimate disposal of the solutions used in the process to clean this equipment would be in accordance with the Resource Conservation and Recovery Act (RCRA) and other applicable regulations.

2.4.1 Old NEPACCO Equipment

This equipment includes: "Cleaned-Still Detectable" equipment which was previously cleaned, retested and found to be still contaminated; "Six Tanks Containing NEPACCO Residues" from processes attributed to NEPACCO operations; and "Out-of-Service" equipment which has not been cleaned. It should be noted that the residues from the "Six Tanks" have been removed, containerized and stored onsite in the Photolysis Area. The "Clean-Still Detectable" and "Six Tanks" equipment would be cleaned with an acid wash prior to detergent and solvent washes. The "Out-of-Service" equipment would be cleaned with detergent washes and wipe tested subsequent to the approved cleaning process. The following table indicates what action would be taken subsequent to equipment testing.

Level of Dioxin	Action
Less than 10 ng/m^2	Possible Reuse
10-100 ng/m^2	Landfill or Scrap Metal
100-1000 ng/m^2	Foundry Disposal
Greater than 1000 ng/m^2	Hold until proper disposal technology is developed or reclaim using alternate techniques.

Disposal of cleaning solutions would be consistent with the option proposed for disposal and destruction of contaminated soils. These solutions would either be concentrated or thermally treated immediately following the cleaning process.

2.4.2 Photolysis Equipment

Proposed remediation of this equipment included a series of solvent and aqueous rinses; the first consisting of isopropanol or fuel oil, the second consisting of a mixture of phosphoric or hydrochloric acid and water followed thirdly by an acid rinse. The rinses would be initiated at the beginning of the photolysis process and would be flushed through each piece of equipment and transfer line which handled stillbottom residues. The rinses generated would be drummed for eventual disposal in an approved manner, as described under Section 2.4.1. After the rinses the equipment would be completely dismantled, inspected, recleaned as necessary and wipe tested. If the wipe test results are less than 10 ng/m^2 the equipment would be stored for possible use. Otherwise the equipment would be disposed of in the manner described under Section 2.4.1.

3.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF THE ALTERNATIVES

The alternatives described in Section 2.0 were evaluated using evaluation criteria presented in EPA Directive 9355.3-02, "Draft Guidance on Preparing Superfund Decision Documents: The Proposed Plan and Record of Decision." These criteria

relate directly to factors mandated by SARA in Section 121 and considerations which measure the overall feasibility and acceptability of the remedy. These evaluations are summarized below.

3.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Protection of human health and the environment is the central mandate of CERCLA, as amended by SARA. Protection is achieved by reducing risks to acceptable levels and taking action to ensure that there will be no future unacceptable risks to human health and the environment through any exposure pathway. Each remedial alternative will have different long-term and short-term effects on the protection of human health and the environment.

All the alternatives evaluated the Proposed Plan provide some degree of protection to public health and the environment. However, the degree of protection and the permanence of the protectiveness vary between the alternatives. Alternatives involving excavation of soils contaminated with greater than 20 ppb dioxin would provide a high long-term degree of protection for human health. Alternatives involving long-term management of soils left (containing less than 20 ppb) in-place would adequately protect human health and the environment and require regular monitoring, maintenance and the use of access restrictions to adequately assure the continued effectiveness of the remedy.

Concentrations of dioxin in surface soil as high as 1380 ppb have been detected at Syntex, Verona. While these levels represent a potential threat to public health, there is no indication that the environment has been impaired significantly. The primary environmental concern at Syntex, Verona is the potential migration of dioxin into the Spring River. The Syntex, Verona site is a relatively flat area, most of which is within the 100-year flood plain of the Spring River. The Trench Area is the only subsite not within the 100-year flood plain. During rain events, stormwater generally collects in the Slough Area where it drains to the Spring River or infiltrates into the ground.

Reducing surface dioxin concentrations from as high as 1380 ppb to 20 ppb or less would substantially reduce any potential for harm to the environment from contaminated soils. Maintaining existing vegetation covers over areas where dioxin concentrations are below the 20 ppb action level, would effectively minimize the potential for human contact and environmental impairment, provided the continued integrity of the vegetative cover is maintained. A cleanup level of 20 ppb dioxin has been established for all areas of the Syntex, Verona site, as no part of the site is considered to be a residential area. The Agency believes that the continued non-residential usage of the Syntex, Verona site is assured through a combination of existing contractual and statutory controls and practical considerations. For example, as the 20 ppb dioxin action level corresponds to non-residential land use at the Syntex, Verona site, federal and state health advisories do not allow residential use of the site. Furthermore, Syntex, Verona is listed on Missouri's Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites. Missouri law provides that the State must concur with a request to change the land usage of any site on this registry. By this mechanism, the State of Missouri has control over future land use at the Syntex, Verona site.

Concentrations of organic contaminants other than dioxin have been detected at the Syntex, Verona site. However, the levels of surface soil contamination for

contaminants other than dioxin in the plant site area have been determined not to be of concern by the ATSDR. Nevertheless, a significant quantity of those soils will be covered or removed during the proposed remedial action presented in this document. The Proposed Plan contemplated that additional groundwater monitoring would be conducted at the plant site and in the Trench Area. If this monitoring revealed that these contaminants exist in the groundwater at levels of concern the necessary remedial actions would be implemented through a second operable unit.

In-place containment of contaminated areas by covering with vegetation would achieve the objectives of minimizing human or animal contact with surface concentrations of dioxin and minimizing dispersal of dioxin-contaminated soils via wind or water erosion. The vegetative cover would be designed to remain effective for a specified duration. As a part of the response action, monitoring, maintenance and institutional controls would serve to assure that the cover integrity will be maintained. Future land-use restrictions would also serve to protect the soil cover and prevent possible human exposure and offsite migration of dioxin in the event of cover failure.

The thermal treatment alternative considered for excavated soils represents a demonstrated technology capable of achieving destruction of dioxin in soils to undetectable levels. This alternative would provide the highest level of protection of human health and the environment because the toxicity, mobility and volume of the materials which pose a threat to public health and the environment would be eliminated. All dioxin-contaminated soils exceeding a level of concern for public health would be treated thermally resulting in the destruction and permanent removal of dioxin from the environment.

Dust and particulates may be generated during materials handling and preparation activities. Measures would be taken to ensure that these potential hazards are controlled prior to full-scale operation. Workers would be protected through measures to be outlined in the Syntex Implementation Plan, project-specific health and safety plans and by adherence to Occupational Safety and Health Act (OSHA) regulations.

The soil excavation alternative would involve transportation of dioxin-contaminated soils to an offsite location for treatment or disposal. Special considerations would be required to assure the short-term protection of human health and the environment during transport. These considerations would include the method of containment and transport of contaminated soil, transportation routes and scheduling of hauls.

3.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with applicable or relevant and appropriate requirements (ARARs) under Federal and State environmental laws. The following potential ARARs have been identified and evaluated for remedial alternatives at Syntex, Verona:

- o Resource Conservation and Recovery Act
- o Missouri Hazardous Waste Management Law
- o Federal and State Water Quality Criteria
- o Federal, State, and County Transportation Requirements

- o State and County Air Pollution Control Requirements
- o State and County Solid Waste Disposal Regulations

Those ARARs which have the most substantial impact on the remedy selection are discussed below.

3.2.1 Resource Conservation and Recovery Act (RCRA)

RCRA, as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes as defined in 40 CFR Part 261. As of July 15, 1986, certain dioxin-containing wastes are specifically regulated under RCRA as hazardous wastes (the "dioxin rule," 50 FR January 14, 1985). The dioxin-contaminated soil left in place at the Syntex, Verona site currently is not under the jurisdiction of RCRA because the soil was contaminated prior to the effective date of the "dioxin rule." However, RCRA may be considered applicable, relevant and appropriate to some alternatives for remediation of dioxin-contaminated soils and solvents or rinses generated during equipment remediation at the site. RCRA would be applicable to the removed soil since the act of excavation constitutes generation of a RCRA listed hazardous waste. Also, a RCRA permit has been obtained for the incinerator located at Denney Farm which will potentially receive excavated soil from the Syntex, Verona facility.

Appropriate RCRA regulations must be considered for any treatment, storage or disposal actions included in any of the alternatives. Onsite actions and storage of dioxin contaminated soil (in the event that excavated soils are not incinerated at the Denney Farm site) performed under the authority of Section 106 of CERCLA are exempt from obtaining RCRA permits; nevertheless, the substantive provisions of the permitting requirements must be met. In addition, RCRA requirements would pertain to any off-site management of hazardous wastes in the event that becomes necessary.

Soils contaminated with greater than 20 ppb dioxin will be excavated as part of the selected remedy. These soils will either be transported to an offsite treatment facility or stored onsite until such a facility becomes available. Storage of the excavated soils if necessary, will be conducted as a temporary measure and will not be subject to requirements specified under RCRA Section 264.

The RCRA program is delegated to the State of Missouri, with the exception of HSWA regulations. The Missouri Hazardous Waste Management Law is nearly identical to RCRA in the regulation of dioxin wastes.

Delisting: RCRA allows for the "delisting" of hazardous wastes if it can be demonstrated that the waste no longer meets the criteria for which it was originally listed as a hazardous waste. Decontamination wastewaters, landfill leachate, and incinerator residues (ash, flyash, and scrubber blowdown) must be delisted if they are to be disposed of as nonhazardous waste. Residues from the incineration of dioxin wastes are specifically listed as "toxic" hazardous waste F028, until delisted.

The delisting process normally entails preparing a delisting analysis using a contaminant migration model (51 FR July 29, 1986) for assessing migration potential. A formal delisting petition is generally required for non-CERCLA and offsite CERCLA actions. A delisting petition is approved by the EPA Administrator and requires a rule change to formally "delist" a hazardous waste.

However, it has been EPA's policy that in order to delist residues that are generated from CERCLA actions that are managed onsite, these residues must meet the substantive requirements of the delisting procedure while not having to meet administrative petition requirements. A formal delisting petition would be required for residues generated from the treatment of offsite dioxin-contaminated soils if the residues are to be managed subsequently as a solid waste.

Thermal Treatment Standards: The dioxin-listing rule establishes standards for incineration and certain types of thermal treatment. It states that incinerators burning the listed dioxin wastes must achieve a destruction and removal efficiency (DRE) of 99.9999 percent, in addition to the other standards contained in 40 CFR 264.343 and 265.352. Residues resulting from the incineration or thermal treatment of dioxin-contaminated soils (F028 wastes), like other dioxin-containing wastes, must be tested to determine whether detectable levels of specific categories of dioxins, chlorinated dibenzo-furans, and certain chlorophenols are present in the extracts from the waste or treatment residuals.

3.2.2 Clean Water Act

Federal ambient water quality criteria (established under the Clean Water Act) provide an estimate of the ambient surface water concentration that will not result in adverse health effects in humans, or the concentrations associated with certain incremental cancer risks. Federal ambient water quality criteria for 2,3,7,8-TCDD are the same as the Health Advisory levels. Federal ambient water quality criteria represent enforceable regulatory standards, and are applicable to any alternative involving discharge into the Spring River.

3.2.3 Missouri Water Quality Criteria

The State of Missouri has adopted regulatory standards for dioxin for protection of aquatic life and drinking water. These standards are below analytical detection levels. Under the Missouri water pollution regulations, dioxin is listed as "persistent and bioaccumulative" (Missouri Water Quality Commission 10 CSR-20-7), and discharge of any amount into the waters of the state is not allowable. The state interprets these regulations to limit dioxin concentrations in discharges to waters of the state to less than the detection level, or 1 ppt. None of the alternatives evaluated include discharge into the Spring River. The state water quality criteria considered to constitute ARARs will be addressed in a future operable unit if necessary.

3.2.4 Solid Waste Disposal Regulations

Solid waste disposal at the Syntex, Verona site is regulated by the MDNR in accordance with the requirements of the Missouri Solid Waste Law and Regulations. Missouri regulations require that solid waste, in general, be disposed of in a landfill meeting design and operating requirements of a demolition or sanitary landfill. A special category known as, "special waste," has been created for those solid wastes requiring handling other than normally used for municipal wastes. Special wastes are subject to waste specific disposal requirements established on a case-by-case basis. Incinerator ash is generally considered a special waste. These special waste requirements may apply to the disposal of delisted incinerator ash generated from the treatment of dioxin-contaminate soil, or the disposal of uncontaminated structures, equipment and debris.

3.3 REDUCTION OF TOXICITY, MOBILITY OR VOLUME

This evaluation criteria relates to the performance of a technology or remedial alternative in terms of eliminating or controlling risks posed by the toxicity, mobility, or volume of hazardous substances.

Dioxin-contaminated soil would remain in place if a containment alternative is implemented. The toxicity and volume of contaminants would remain at current levels. The stabilization by installation and/or maintenance of a vegetative cover, coupled with dioxin's affinity for and adherence to soil particles, will effectively minimize the mobility of dioxin.

Thermal treatment is capable of removing the dioxin from the soil and destroying the dioxin. Thermal treatment has been proven to destroy dioxin, and thus permanently removes the contaminant from the environment, eliminating mobility and toxicity. The volume of the wastes, while reduced to some extent in the incineration process, would no longer be relevant since the wastes would no longer be hazardous.

3.4 SHORT-TERM EFFECTIVENESS

Short-term effectiveness addresses how well an alternative is expected to perform, the time to achieve performance and the potential adverse impacts of its implementation.

Of the alternatives evaluated, in-place containment of contaminated soils would provide the highest level of short term protection. Short-term protection is high because implementation of in-place containment does not involve excavation or other soil-disturbing activities which could potentially affect site workers or the surrounding community.

Alternatives involving the excavation and subsequent management of dioxin-contaminated soils and remediation of dioxin-contaminated equipment provide increased opportunity for exposure to contaminants by site workers due to soil disturbing activities. Thermal treatment alternatives would require additional soil handling operations to render the soil suitable for the treatment process. Worker exposure could potentially occur through direct contact, ingestion or inhalation of contaminated soil particles and solvents or other rinses used in equipment remediation. Measures could be implemented which would control the potential for worker exposure during soil-disturbing and handling activities. These measures include use of protective clothing and effective dust control. These same measures would also assure the short-term protection of the surrounding community during periods of excavation and soil handling.

A limited potential exists for contaminants to be emitted into the air during operation of the thermal treatment unit. The thermal treatment unit would be equipped with redundant safety features and operated under strict conditions which would control the potential for any hazardous emissions from the thermal treatment unit to occur.

3.5 LONG-TERM EFFECTIVENESS AND PERMANENCE

Long-term effectiveness and permanence addresses the long-term protection and reliability an alternative affords.

In-place containment alternatives provide an acceptable degree of long-term effectiveness and reliability. However, frequent inspection and maintenance of the cap or cover would be mandatory to assure the success of this alternative. Maintenance activities including mowing, fertilizing and repair would serve to increase the effectiveness of the remedy. In addition, access restrictions would be required in order to prevent possible disturbance of the cap or cover.

Thermal treatment of excavated soils provides long-term protection and reliability. Thermal treatment results in the removal and destruction of dioxin in soil and eliminates the potential for future exposure. Following completion of thermal treatment, no residual contamination exceeding a level of concern for public health remains onsite. There are no ongoing maintenance requirements necessary to ensure the continued effectiveness of the remedy.

3.6 IMPLEMENTABILITY

Implementability addresses how easy or difficult, feasible or infeasible, an alternative would be to carry out from design through construction, operation and maintenance.

The implementability of the in-place containment alternatives is affected by technical considerations, such as availability of suitable cover materials (rock, clay, soil and seed for acclimated vegetation) and access to affected areas. The remedial design would take site characteristics into account - for instance, because the site is in a floodplain, it may need flood-proofing in accordance with RCRA requirements.

Implementation of thermal treatment involves relatively complex technologies. These measures have been implemented successfully during the cleanup of other Superfund sites. The time required to complete thermal treatment varies depending upon treatment capacity.

Routine maintenance and monitoring of the thermal destruction unit would ensure reliability and minimize the potential for failure. If monitoring indicates the potential for failure of the thermal destruction unit, the unit would be shut down until corrective measures are taken. Operation of thermal destruction units has shown that they are capable of successfully destroying dioxin-contaminated materials and are able to meet applicable or relevant and appropriate requirements. In addition, operation of the EPA mobile incinerator system has demonstrated that the residues from the treatment of dioxin-contaminated materials can be successfully delisted.

It should be noted that full-scale operation of transportable incineration units at hazardous waste sites has been limited. Some such units have experienced extended periods of downtime. It is possible that operation of the unit at Denney Farm would result in some extended downtime periods. The downtime periods could delay the completion of thermal destruction of contaminated soils.

3.7 COST

CERCLA requires that EPA select the most cost-effective (not merely the lowest cost) alternative that protects human health and the environment and meets other requirements of the law. Costs for the operable unit included in this plan will be incurred by Syntex for the duration of the remedial action including the necessary operation, maintenance and review and any additional action that may be determined to be necessary as a result of that operation, maintenance and review. Cost estimates for the proposed remedial alternatives are presented in Table 3.1.

The estimates presented do not consider the potential replacement cost for containment or disposal alternatives which may be required in the event of failure.

3.8 COMMUNITY ACCEPTANCE

This evaluation criteria addresses the degree to which members of the local community support the remedial alternatives being evaluated.

The local community has demonstrated favorable support for the proposed remedy. Comments received from the responding community have focused on implementation of the proposed remedy and the timeliness of the implementation process. Residents attending the public meeting indicated support for excavation and treatment of surface soils containing greater than 20 ppb dioxin and maintenance of a vegetative cover over soils containing between 1 ppb and 20 ppb dioxin.

A specific concern regarding remediation of the Slough Area was presented by the City of Verona. A gravity flow wastewater effluent line discharges to the Slough in the area proposed for remediation. It has been proposed that this discharge line be relocated in a manner that facilitates gravity flow from the wastewater treatment plant and allows filling of the Slough channel as specified in the selected remedy.

One commenter expressed concern over the 20 ppb action level and the study upon which it is based. Comments generally criticize the action level as too conservative and called the assumptions used on the quoted study as invalid. The supported action level established for the Syntex, Verona site is based upon the 1984 report entitled, "Health Implications of 2,3,7,8 Tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," Renate D. Kimbrough, M.D., et.al., Center for Environmental Health, Centers for Disease Control (CEH/CDC). The EPA believes that the 1984 CDC report is a valid risk assessment upon which to base an action level. The CDC has recently supported the paper stating that no scientific evidence has been reported in the literature to date which would invalidate the assumptions upon which the 1984 risk assessment is based, or its conclusions.

The option of removing contaminated soils from the site and transporting the soils to and incinerating the contaminated soils at the Denney Farm site would be acceptable to the surrounding community. To date the incinerator at Denney Farm has received contaminated soils from other sites located in the vicinity. This remedial alternative, removing and transporting contaminated soils to and incinerating at the Denney Farm site, has been accepted as a preferred

TABLE 3.1

ESTIMATED COST OF PROPOSED REMEDIAL ALTERNATIVE

1. STABILIZATION	
A. Maintain Vegetation/In-place containment	
Grid Area	$10,000
Slough Area	$275,000
Trench Area	$375,000
2. REMOVAL	
A. Excavate Gravel, Transport, Backfill, Vegetate	
Spill Area	$14,000
B. Excavate and Incinerate Soil, Transport, Backfill, Vegetate	
Burn Area	$453,000
Irrigation Area	$750,000
Lagoon Area	$2,500,000
3. EQUIPMENT REMEDIATION	
Old NEPACCO Equipment	$300,000
Photolysis Equipment	$750,000
Solvents & Washes	$190,000

(approximately 15 miles away) for thermal treatment at the incinerator located at the Denney Farm, provided that Syntex executes an access agreement with the owner of Denney Farm. The incinerator will remove the dioxin from the soil and destroy the dioxin. The resulting ash will be disposed of at a state approved landfill. The resulting wastewater will be discharged under an approved state permit.

If Syntex is unsuccessful in its efforts to reach such an agreement for the purpose of incinerating these soils, the contaminated soil will remain onsite; soils will be excavated no later than one year after EPA approval of the Syntex Implementation Plan and stored onsite in accordance with the applicable EPA rules and regulations. Clean backfill material will be placed in the area of excavation, followed by six inches of topsoil, the surface of which will be graded for drainage. A vegetative cover will be established on the graded topsoil surface to complete the remedial action.

4.2 SUBSITE REMEDIAL ACTION

4.2.1 "Grid" Area

The average dioxin surface concentration in the "Grid" Area is 0.15 ppb; the highest concentration is 3.1 ppb. Maintenance of the existing vegetative cover to prevent erosion will provide adequate protection of the public health.

4.2.2 Burn Area

The average dioxin surface concentration in the Burn Area is 6.5 ppb; the highest concentration is 24 ppb at the surface and 27 ppb at depth. In order to provide a remedy which is protective of the public health, all soils containing 20 ppb or more dioxin based on the 95 percent confidence level sampling, will be excavated up to a four-foot depth, to bedrock or to a dioxin concentration less than the action level whichever occurs first. An estimated total of 30 cubic yards of contaminated soils will be excavated and incinerated as described, in Section 4.1.

4.2.3 Spill Area

The average dioxin surface concentration in the Spill Area is 2.0 ppb; the highest concentration is 4.8 ppb. Because this area has a 6-inch surface layer of gravel (underlain by a 10-mil polyethylene sheet) which will not support a vegetation cover, the gravel and polyethylene sheeting will be removed and the area will be backfilled with topsoil. The topsoil then will be reseeded with grasses to prevent erosion, thus protecting the public health. The excavated gravel will be used as backfill in other, more contaminated areas (such as the lagoon area).

4.2.4 Irrigation Area

The average dioxin surface contamination level in the Irrigation Area is approximately 4.0 ppb; the highest concentration is 29 ppb. In order to provide a remedy which is protective of the public health, all soils containing 20 ppb or more dioxin based on the 95 percent confidence level sampling will be excavated up to a four-foot depth, to bedrock or to a dioxin concentration lessthan the action level whichever occurs first. An estimated total of 30 cubic yards of

TABLE 4.1

Selected Remedy for Syntex Verona

	AREA	REMEDY
a.	Grid Area	Maintain Vegetation
b.	Burn Area	Excavate soils >20 ppb, incinerate, dispose ash/residue as appropriate, backfill with clean material, and reestablish vegetation.
c.	Spill Area	Remove gravel, backfill with topsoil, and establish vegetation.
d.	Irrigation Area	Excavate soils >20 ppb, incinerate, dispose ash/residue as appropriate, backfill with clean material, and reestablish vegetation.
e.	Trench Area	Backfill, grade, provide a 12" cover and, establish and maintain vegetative cover. Establish subsurface monitoring of unsaturated and/or saturated zones. Five year review.
f.	Lagoon Area	Excavate soils >20 ppb, incinerate, dispose ash/residue as appropriate, backfill with clean material, and reestablish vegetation.
g.	Slough Area	Establish and maintain vegetation cover.
h.	NEPACCO Equip.	Clean, wipe test, and determine proper disposal or reuse conditions.
i.	Photolysis Equip.	Solvent rinse, acid rinse, water rinse, disassemble, inspect, wipe test, and determine proper disposal or reuse conditions.
j.	Groundwater	Groundwater monitoring/ remediation for the plant site and trench area will be addressed in a future operable unit.
k.	Solvents and Washes	Transport solvents to RCRA permitted facility for treatment and/or disposal (subject to land ban), treat aqueous washes.

contaminated soils will be excavated and incinerated as described above. in Section 4.1.

4.2.5 Lagoon Area

The average dioxin surface contamination in the Lagoon Area is 279 ppb, the highest concentration is 1380 ppb, which exceeds the action level for industrial and nonresidential areas. In order to provide a remedy which is protective of the public health, all soils containing 20 ppb or more dioxin based on the 95 percent confidence level sampling at the subsite, will be excavated up to a four-foot depth, to bedrock or to a dioxin concentration less than the action level whichever occurs first. An estimated total of 800 cubic yards of contaminated soils will be excavated and incinerated as described above in Section 4.1.

4.2.6 Slough Area

The average dioxin concentration in the Slough Area is 1.5 ppb, the highest concentration is 8.4 ppb. In order to provide a remedy which is protective of the public health, a vegetative cover will be established and maintained over all soils containing 1 ppb or more dioxin. This activity would involve placing clay in the Slough channel as a backfill material and grading the surface to produce a gradual swale. Six inches of topsoil would then be added to support a vegetative cover.

4.2.7 Trench Area

The average dioxin concentration in the Trench Area is less than 17.3 ppb; the highest concentration is 67 ppb. These samples were composited from the surface to a depth of 9 to 12 feet. Unlike the other subsites which lie in the floodplain, the Trench Area is underlain by a substantial layer of low permeability soils. predominantly clay. Borings beneath the Trench Area have revealed nondetectable levels of dioxin. Excavation of the Trench Area may result in migration of contaminants located there as the excavation activities could disrupt the low permeability layers beneath the subsite. For this reason, remediation of the Trench Area, under this operable unit, will include: backfilling trench depressions to original grade with gravel aggregate; installation of a 12 inch clay layer that will extend ten feet beyond trench boundaries; and subsequent installation of 12 inches of topsoil to support a vegetative cover. In addition, a gravel, drainage-interception trench will be installed upgradient of the trench area. A five year review will be conducted at the Trench Area because contamination will remain above health-based criteria. This review will assure effectiveness of the remedy in the Trench Area. Additional subsurface monitoring, described in Section 4.2.11, will be implemented concurrently with this remedial action. If monitoring reveals contamination of the groundwater in this area at levels of concern, additional remedial action will be implemented through an additional operable unit.

4.2.8 Old NEPACCO Equipment

This waste unit comprises process equipment at the Syntex, Verona site which is contaminated and requires remedial action. Some of the equipment was cleaned but still has detectable dioxin surface contamination. The contaminated equipment will be cleaned using an acid wash followed by detergent and solvent washes. Equipment cleaned to less than 10 ng/m2 may be released for reuse.

while equipment still contaminated to greater than 10 ng/m2 must be disposed in accordance with RCRA requirements. Treatment and disposal of the solvents and wash solutions is discussed below. This remedy will protect the public health and the environment.

4.2.9 Photolysis System

The photolysis equipment used to degrade dioxin in the still bottom wastes from tank T-1 will be decontaminated using solvent and aqueous washes. After washing, the equipment will be completely dismantled and inspected. If wipe tests indicate surface contamination less than 10 ng/m^2 the equipment may be released for reuse. Otherwise, the equipment will be disposed in accordance with RCRA requirements.

4.2.10 Solvents Washes

All solvents used during the remedial activities will be collected and shipped for treatment and/or disposal at a RCRA permitted facility. Aqueous washes from equipment cleaning processes will be treated to remove dioxin, using a proprietary Syntex process. The effluent water from the treatment process having a dioxin concentration of less than 1 ppt will be treated by evaporation. Any filter cake or carbon materials generated by the treatment process will be transported to a RCRA-permitted facility for treatment and/or disposal.

4.2.11 Groundwater

Activities under this first operable unit will not include remediation of the local groundwater as the EPA at this time does not have sufficient data on which to determine groundwater remediation needs. Efforts to assess and monitor the local and area groundwaters will be initiated concurrently with implementation of this plan. If data generated from this monitoring shows contamination of the groundwater at levels of concern, remediation of the groundwater will be conducted through a second operable unit. This assessment and monitoring effort will include the installation of groundwater monitoring well clusters in the Trench Area and upgradient and downgradient of the plant site.

4.2.12 Spring River

Efforts to monitor Spring River fish and sediment will continue as specified in the Syntex, Verona Fish and Sediment Sampling Plan. As with the groundwater, if data generated during the monitoring activities reveals contamination at levels of concern, remediation of the Spring River will be conducted through an additional operable unit.

4.3 REMEDY SUMMARY

The remedy selected under the first operable unit for the Syntex, Verona site will address only the dioxin-contaminated soils, equipment and debris at the facility. Spring River and local groundwater remediation at the plant site and in the Trench Area, if determined to be necessary by the EPA, will be addressed in a second operable unit. The selected remedy represents a combination source-control and stabilization measure for dioxin-contaminated materials at the site. A five year review will be conducted at the Trench Area because contamination will remain above health-based criteria. This review will assure effectiveness of

the remedy in the Trench Area.

A site-specific action level of 20 ppb has been established as an appropriate cleanup level for Syntex, Verona. This action level will result in the excavation of approximately 860 cubic yards of dioxin-contaminated soil from Syntex, Verona which will be transported and treated thermally at the Denney Farm incinerator or stored onsite in accordance with applicable EPA rules and regulations. The thermal treatment process utilized in the treatment of excavated soils will result in the removal of dioxin from the soil and destruction of the dioxin. The residue ash from the treatment will be proposed for delisting and disposed as a solid waste at an approved location. Following implementation of the described action, access restrictions will be maintained at the site.

5.0 STATUTORY DETERMINATION

Based upon available information, the selected remedy satisfies the remedy selection requirements under CERCLA, as amended and the National Contingency Plan. The selected remedy at the site is protective of public health and the environment, satisfied all identified applicable or relevant and appropriate environmental requirements and is cost-effective. Federal and state health officials have determined that removing all soils exceeding 20 ppb dioxin in industrial or nonresidential areas, and establishing and maintaining vegetation covers over all soils containing less than 20 ppb dioxin at the Syntex, Verona site will adequately achieve protection of public health.

The selected remedy under the first operable unit at the Syntex, Verona site provides protection of the environment by preventing the mobilization of dioxin-contaminated soils by erosion and by removing and treating soils contaminated in excess of the 20 ppb action level. Erosion is prevented in soils having dioxin concentrations below the action level either by maintaining existing vegetative covers or by establishing new vegetative covers. On the basis of existing data, the Syntex, Verona site is not a significant source of dioxin to the Spring River. The vegetative covers will ensure that the potential for transport of dioxin into the Spring River is no more than the existing non-detectable rate and that the direct contact exposure pathway is controlled for area wildlife. Prior investigations have detected no release of dioxin through airborne or groundwater pathways.

The estimated costs of the entire project potentially includes costs of excavation, transportation, treatment, providing soil backfill and vegetative covers, cover maintenance and verification sampling. Costs of the remedy largely depend on the volume of soils excavated and costs of thermal treatment. The potential total costs for cleanup of the site is approximately $5.62 million. Inclusion of the soil volumes excavated from the Syntex, Verona site in the other total volumes estimated for transport to the Incinerator Unit at Denney Farm will promote considerable cost savings.

The thermal treatment alternative presented in this document for soils containing more than 20 ppb is the only implementable alternative identified which is protective and attain federal and state environmental and public health requirements. The thermal treatment alternative also satisfies the statutory preference under SARA for remedies which reduce the toxicity, mobility, or volume of hazardous waste and utilize alternative treatment technologies to the maximum extent practicable.

RESPONSIVENESS SUMMARY

RECORD OF DECISION
FOR
FINAL MANAGEMENT OF
DIOXIN-CONTAMINATED SOIL
AND EQUIPMENT AT

SYNTEX AGRIBUSINESS, INC.
VERONA, MISSOURI

Prepared by

U. S. ENVIRONMENTAL PROTECTION AGENCY

April 29, 1988

RESPONSIVENESS SUMMARY

Record of Decision for
Final Management of Dioxin-Contaminated Soil and Equipment Syntex Agribusiness, Inc.
Verona, Missouri

This Responsiveness Summary presents responses of the Environmental Protection Agency (EPA) to public comments received regarding the proposed remedial actions for dioxin-contaminated soil and equipment at the Syntex Agribusiness Site in Verona, Missouri. This document addresses all comments received by the Agency during the public comment period conducted as part of the remedy selection process. Several additional comments were received by the Agency following the close of the public comment period. All such comments received prior to publication of this responsiveness summary have also been addressed.

Comments to the EPA documents listed below in reference to the Syntex, Verona Proposed Plan, were also received during the public comment period. These documents and comments to these documents are hereby incorporated by reference into the Administrative Record.

1. September 4, 1986 on the Draft Minker/Stout/Romaine Creek Feasibility Study ("Draft M/S/RC FS").

2. March 26, 1987 on the Draft Times Beach Remedial Investigation/Feasibility Study ("Draft Times Beach RIFS").

3. September 18, 1987 on the Proposed Plan for Interim Management of Dioxin-Contaminated Sediment, Romaine Creek Portion of the Minker/Stout/Romaine Creek Site (August 1987); on the Public Comment Draft Operable Unit Feasibility Study, Romaine Creek Portion of the Minker/Stout/Romaine Creek Site (July 8, 1987); on the Proposed Plan for Interim Management of Dioxin-Contaminated Sediment, Stout Portion of the Minker/Stout/Romaine Creek Site (August, 1987); and on the Public Comment Draft Operable Unit Feasibility Study, Stout Portion of the Minker/Stout/Romaine Creek (Site (July 8, 1987) ("M/S/RC OUFS").

4. March 17, 1988 on the Public Comment Draft Proposed Plan for Final Management of Dioxin-Contaminanted Soil and Final Disposition of Structures and Debris at Times Beach, Missouri and the Minker/Stout/Romaine Creek Site, Missouri ("Times Beach Proposed Plan").

5. "Draft Toxicological Profile for 2,3,7,8-Tetrachlorodibenzo-p-dioxin," Agency for Toxic Substances and Disease Registry, November 1987.

INTRODUCTION

On March 21, 1988 EPA announced its Proposed Plan for the cleanup of the Syntex Agribusiness, Inc. site in Verona, Missouri. Under the Proposed Plan, soils

containing greater than 20 ppb dioxin, as confirmed by the 95 percent confidence level sampling protocol, would be excavated and treated offsite. A vegetative cover would be established and maintained over soils contaminated with between 1 ppb and 20 ppb dioxin. Remediation of the Trench Area would include installation of a vegetative clay cap and an upgradient gravel, drainage-interception trench. In addition, dioxin-contaminated equipment would be cleaned through a series of rinses.

A cleanup level of 20 ppb dioxin has been established for the Syntex, Verona site by EPA on the basis of recommendations from Federal and State health agencies. This cleanup level is appropriate for the Syntex, Verona site and is consistent with the current and future land use of the site as an industrial facility. Future land use at the Syntex, Verona site will be controlled through institutional measures including placement on the Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites and site access controls and restrictions. These controls will assure that the proposed cleanup of the Syntex, Verona site continues to surpass all criteria for the protection of human health and the environment.

Activities conducted under the Proposed Plan will not include remediation of the local groundwater at the plant site and in the Trench Area as the EPA at this time does not have sufficient data on which to determine groundwater remediation needs. Efforts to assess and monitor the local and area groundwaters will be initiated concurrent with the Proposed Plan. In addition sampling and analysis of Spring River fish and sediments will continue as required. If data generated from this monitoring shows contamination of the groundwater or Spring River at levels of concern remediation will be conducted.

PUBLIC PARTICIPATION

On March 21, 1988 the Agency released the Syntex "Remedial Alternatives Report" and the EPA "Proposed Plan for Final Management of Dioxin-Contaminated Soil and Equipment at Syntex, Verona." A public meeting to discuss the Syntex Report and EPA Proposed Plan was held on March 29, 1988. The public comment period on the Syntex Report and EPA Proposed Plan was concluded April 22, 1988.

This Responsiveness Summary represents a component of the Record of Decision (ROD) package, which also includes the ROD declaration, ROD summary and index to the administrative record. Formal selection of the remedy to be implemented for the Syntex, Verona site occurs by signature of the ROD declaration by the Regional Administration for EPA Region VII.

Following the ROD signature an Implementation Plan will be prepared by Syntex. This plan will include the design details for implementation and maintenance of the selected remedy. A review of the Syntex Implementation Plan will be conducted by the Agency to assure compliance with the selected remedy. Implementation of the remedy will commence upon approval of the Syntex Plan by the Agency.

The following are summaries of comments received in response to the Proposed Plan and the Agency's response to these comments.

EPA received several comments pertaining to health issues addressed in the Draft Times Beach Remedial Investigation/Feasibility Study, the Minker, Stout Romaine Creek Operable Unit Feasibility Study and the Times Beach Proposed Plan.

The supported action level established for the Syntex, Verona site is based upon the 1984 report entitled, "Health Implications of 2,3,7,8 Tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," Renate D. Kimbrough, M.D., et.al., Center for Environmental Health, Centers for Disease Control (CEH/CDC). The EPA believes that the 1984 CDC report is a valid risk assessment upon which to base an action level. The CDC has recently supported the paper stating that no scientific evidence has been reported in the literature to date which would invalidate the assumptions upon which the 1984 risk assessment is based, or its conclusions. Additionally, responses to specific inquiries and comments to the Times Beach and M/S/RC documents will be presented in the Times Beach Responsiveness Summary. EPA will respond to these comments which in general pertain to health issues and the basis for the stated action level at the Syntex, Verona site.

EPA received comments to the Draft Toxicological Profile for 2,3,7,8-Tetrachlorodibenzo-p-dioxin.

This document is currently in draft form and has not provided a basis on which decisions were made at the Syntex, Verona site. EPA has based its decisions at the site on the 1984 risk assessment conducted by Kimbrough, et.al. The Center for Disease Control has recently reaffirmed its support of the assumptions and conclusions presented in the 1984 study. It should be noted that the Draft profile presents a compilation of information on the physical, chemical and toxicological properties which have been provided in the currently available literature. Comments to the draft profile will be forwarded to the ATSDR and will be incorporated into the Administrative Record for the Syntex, Verona site.

EPA received a comment requesting clarification on the land use restrictions needed for the proposed cleanup.

EPA has recognized the need to provide institutional controls and access restrictions at the site to assure the effectiveness of the selected remedy. These controls will include deed restrictions and maintenance of the site on the State of Missouri "Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites". In addition, plant site access is restricted by a perimeter fence and during periods of plant shut down a 24-hour guard is provided. Subsite access will be further restricted by perimeter fencing. Additional restrictions necessary for the protection of the soil cover will be provided in the Syntex Implementation Plan.

EPA was asked what erosion protection would be provided to assure soil stability in areas containing less than 20 ppb dioxin.

Details on the operation and maintenance of the selected remedy including maintenance of the vegetative soil covers will be provided in the Syntex Implementation Plan. The Syntex Plan will be reviewed and approved by EPA prior to implementation.

In 1986, the Centers for Disease Control provided to Congress a "Detailed Response to Subcommittee Questions on Dioxin." In their response to a question on the current extent of knowledge concerning the human health effects, CDC stated that:

> **"A number of epidemiology studies and health assessments in humans have given negative results. For various reasons, the results of these negative studies are not convincing, particularly because of the overriding effects of confounding variables."**

CDC further states that:

> **"The lack of definitive human data forces the use of animal data for predicting possible human health effects."**

and:

> **"... in the absence of useful human data to the contrary, prudent public health policy dictates an assumption that humans could suffer effects similar to those observed in animals and that preventative public health policy must be based on available animal data."**

The 1984 risk assessment which supports the recommendations for cleanup levels at Syntex, Verona is based upon animal health studies. This assessment has been consistently applied during the cleanup of dioxin sites in Missouri, and remains valid for remediation of the Syntex, Verona site.

> **A commenter asked if there was conclusive evidence regarding dioxin's risk acceptability. EPA was asked if the toxicity of dioxin to humans, apart from chloracne, has been demonstrated.**

There is disagreement in the scientific community regarding the risks due to exposure to dioxin. The position of EPA is to take a conservative approach to ensure that any error made in the assessment of risk is made of the side of safety. CDC has recently affirmed support of the 1984 health assessment that established the original action level for exposure to dioxin in a residential setting. There has been no scientific evidence presented to date that invalidates the 1984 assumption of conclusions.

> **The EPA received a comment concerning the Proposed Plans statement that TCDD is the most potent animal carcinogen evaluated to date by the EPA Carcinogen Assessment Group. The commenter said that this statement is misleading and inappropriate. The commenter further stated that TCDD is not a potent carcinogen if one considers its carcinogenicity relative to its acute toxicity.**

A commenter expressed concern regarding what effect the proposal to fill the Slough subsite area with clay might have on the presence of the City of Verona wastewater outfall.

The Syntex Implementation Plan will address this issue. The gravity flow wastewater outfall can be relocated to a point in the slough, downstream of the proposed filling activity, in a manner that facilitates gravity flow from the wastewater treatment plant and allows filling of the slough channel as specified in the selected remedy.

EPA was questioned regarding the risk posed by the levels of dioxin left onsite. The commenter expressed concern over the continued transport of dioxin to the Spring River.

The cleanup levels discussed in the proposed plan were established for the Syntex, Verona site based upon recommendations from state and federal health agencies. Sampling and analysis of the Spring River fish and sediments will be continued as appropriate to monitor the short and long effects associated with the site and implementation of the selected remedy. EPA feels that these monitoring efforts will provide the necessary information to assure protection of the public health and environment.

EPA received a comment indicating concern over implementation of the remedy without more knowledge on factors affecting transport of dioxin contaminated soils and on mechanisms of dioxin transport to the Spring River.

The selected remedy will serve to remove the major sources of dioxin presently onsite and stabilize areas containing dioxin below the action level. These measures in addition to the necessary maintenance will assure longevity of the selected remedy and reduce if not eliminate potential dioxin transport to the Spring River. Continuing the sampling and analysis of the Spring River fish and sediment will allow the Agency to assess the effectiveness of the remedy as to residual dioxin concentrations left onsite.

Sampling at the Syntex, Verona site and at other Missouri dioxin sites has indicated that the dioxin is tightly bound to soil particles, and that migration of the dioxin is directly related to the transport of the contaminated soils. The EPA does not believe that the dioxin contamination at the Syntex, Verona site represents a significant threat to groundwater or air quality on the basis of previous extensive sampling. Groundwater samples have to date been found to contain nondetectable values with a detection limit of 1 part per quadrillion (ppqd). Sampling of sediment and biota in the Spring River have indicated decreased concentrations over the years sampled and with distance away, downstream of the site.

EPA was asked if a deep tillage/soil inversion technique could be used as the remedy for areas containing from 1 to 20 ppb.

This alternative was considered by EPA, however it was determined not to appropriate at the Syntex, Verona site for areas containing from 1 to 20 ppb.

A commenter suggested that all alternatives including the no action alternative, presented in the "Remedial Alternatives Report" would adequately protect the public health and the environment. The commenter further stated that flaws exist in the assumptions used to establish an action level and that recent scientific advances were not considered.

An action level of 20 ppb dioxin was established for the Syntex, Verona site based upon the 1984 report entitled, "Health Implications of 2,3,7,8 Tetrachlorodibenzodioxin (TCDD) Contamination of Residential Soil," Renate D. Kimbrough, M.D., et.al., Center for Environmental Health, Centers for Disease Control (CEH/CDC). The CEH/CDC has recently supported the 1984 paper stating that no scientific evidence has been reported in the literature to date which would invalidate the assumptions upon which the 1984 risk assessment is based, or its conclusions.

One commenter recommended that the site be left as it is for the time being since the health effects of dioxin to humans are not thought to be significant.

The no action alternative is not considered by EPA to be acceptable for the site; the potential for exposure would continue to exist. A longterm remedy that is compatible with regulatory requirements and provides protection of human health and the environment must be selected. Accordingly the no action is not considered to be a satisfactory selection.

EPA received comments which disputed the information presented in the Proposed Plan on the toxicological effects of dioxin in humans.

The literature contains a number of human health studies which draw conflicting conclusions. A number of these studies were cited by the commenter. The commenter states that "of greatest significance is the study performed on 104 residents of Times Beach" conducted by CDC, Missouri Division of Health, St. Louis University, and St. Joseph's Hospital. This article actually states:

> "The results appear negative, but no overall definitive conclusion should be based solely on this initial study."

The article further states:

> "Public health policy in situations such as this environmental contamination with TCDD must continue to focus on the prevention of any potential health effects (particularly delayed or long-term), even if effects are not demonstrated in a pilot study. For this reason appropriate efforts to prevent human exposure must continue, in this and other similar situations, until a more complete understanding of public health risks is obtained."

The statement made in the proposed plan is technically correct. When considered on a unit risk basis, the cancer potencies of different chemicals can be compared. On the basis of a relative potency index of the 55 chemicals that CAG has evaluated, TCDD is the most potent carcinogen.

The commenter questioned the Proposed Plans statement that TCDD is 50 times as potent as BCME is irrelevant since exposure to BCME at one point was relatively common in several of the chemical industries yet exposure to TCDD is rare. In addition, the commenter stated that there still is no evidence that TCDD is a human carcinogen after 40 years of workplace experience with it.

It is suggested by the commenter that there is no evidence that TCDD is a human carcinogen after 40 years of workplace experience. The commenter also acknowledged, however, that exposure to TCDD in the workplace is rare. The potency of TCDD relative to BCME is relevant and technically correct.

A commenter questioned the use of the EPA 95 percent confidence level sampling protocol, as compared to other similar sampling procedures.

The 95 percent confidence level sampling protocol required by EPA has been extensively peer reviewed and approved by state and federal health and environmental agencies. The EPA sampling protocol has been incorporated into cleanup and sampling plans for all other Missouri dioxin sites that have successfully been remediated or which are currently undergoing remediation.

EPA was asked to clarify the proposed extent of excavation.

Subsite areas which previously were found to contain greater than the 20 ppb dioxin action level will be resampled using the 95 percent confidence level sampling protocol. Those areas found to exceed the action level will be excavated in stages or lifts using either a backhoe or other excavation equipment determined to be the most efficient and cost effective. The excavation activity will proceed until 1) levels of dioxin are below 20 ppb, 2) bedrock is reached, or 3) the four foot depth is reached. Excavation will not proceed below bedrock or the four foot depth.

A commenter strongly suggested that dioxin-contaminated soils remain in-place until a treatment technology becomes available, in the event soils cannot be treated at the Denney Farm incineration unit. In addition, the commenter contends that storage onsite subsequent to excavation creates the need for double-handling and increases the potential for human exposure.

EPA has provided that all soils, contaminated with dioxin above the 20 ppb action level, be excavated within one year after Implementation Plan approval. Excavation within the stated schedule is necessary to assure a timely completion of the remedy and to remove those sources considered to be a threat to public health and the environment. Containerization and storage of the excavated soils will be conducted in accordance to applicable EPA and state rules and regulations; in a manner that substantially reduces any threat to the public health or environment.

EPA was asked whether dioxin-contaminated soils excavated from the Syntex, Verona site would be treated at the Denney Farm incineration unit. The commenter suggested that there were a number of impediments to implementation of the proposed remedy.

EPA is currently working toward an agreement with the appropriate parties which will facilitate treatment of the excavated soils at Denney Farm. In the event these negotiations fail dioxin-contaminated soils excavated during site remediation will be stored onsite in compliance with EPA rules and regulations until an appropriate treatment technology becomes available.

EPA was asked what action would be taken subsequent to the groundwater monitoring program identified in the Proposed Plan.

The EPA at this time does not have sufficient data upon which to base future decisions regarding groundwater remediation. The groundwater monitoring program is an effort, in addition to the existing groundwater monitoring efforts, to further identify the extent of groundwater contamination. At the time sufficient data is received a determination will be made as to the appropriate response action, based on the applicable, relevant and appropriate requirements under federal and state environmental laws.

A commenter suggested that the reference to the Denney Farm incineration unit's capability to successfully destroy dioxin in soil to undetectable levels is an overstatement of the fact. Furthermore the commentor refuted claims that the destruction and removal efficiencies are high enough to allow delisting of the dioxin contaminated soil following treatment.

Analysis of residues generated at the Denney Farm incineration unit have revealed non detectable levels of dioxin, utilizing the detection limits applicable at the time of analysis. These results demonstrate that the incineration unit at Denney Farm is capable of removing residual dioxin to a level which will allow delisting of the contaminated soil from the Syntex, Verona facility.

EPA received a comment questioning the past and present process for delisting residues generated at the Denney Farm incineration unit. the commenter further stated that the current delisting procedures are invalid.

The 1985 delisting procedures were based on knowledge that was currently available at the time regarding safe levels for delisting. The current model used for delisting purposes was published in the Federal Register and is the only model currently approved by EPA for delisting activities. The delisting of this residue is rule making procedure separate and apart from this Record of Decision. Comments pertaining thereto should be addressed to the EPA Office of Solid Waste in Washington D.C.